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Outcomes of Esophagectomy for Esophageal Achalasia in the United States

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Abstract
Background While the outcomes after Heller myotomy have been extensively reported, little is known about patients with esophageal achalasia who are treated with esophagectomy.
Methods This was a retrospective analysis using the Nationwide Inpatient Sample over an 11-year period (2000–2010). Patients admitted with a primary diagnosis of achalasia who underwent esophagectomy (group 1) were compared to patients with esophageal cancer who underwent esophagectomy (group 2) during the same time period. Primary outcome was in-hospital mortality. Secondary outcomes included length of stay, postoperative complications, and total hospital charges. A propensity-matched analysis was conducted comparing the same outcomes between group 1 and well-matched controls in group 2.
Results Nine hundred sixty-three patients with achalasia and 18,003 patients with esophageal cancer underwent esophagectomy. The propensity matched analysis showed a trend toward a higher mortality in group 2 (7.8 vs. 2.9 %, $p=0.08$). Postoperative length of stay and complications were similar in both groups. Total hospital charges were higher for the achalasia group ($115,087 vs. $99, 654.2, $p=0.006$).
Conclusion This is the largest study to date examining outcomes after esophagectomy in patients with achalasia. Based on our findings, esophagectomy can be considered a safe option, and surgeons should not be hindered by a perceived notion of prohibitive operative risk in this patient population.

Keywords Achalasia · Esophagectomy · Outcomes

Introduction

Achalasia is the most common and best-known primary motility disorder of the esophagus and represents the functional esophageal disorder—after gastroesophageal reflux disorder—most likely to necessitate surgical intervention.[1–3] The nature of the disease is progressive, and its treatment is substantially palliative and aims to relieve symptoms through improvement of passive esophageal transit. If left untreated, or if treated improperly, achalasia inevitably causes progressive dilation, elongation, tortuosity, and loss of functionality of the esophagus, eventually leading to the characteristic "sigmoid dolichomegaesophagus".[4] Important morbidities afflict these patients with end-stage disease, such as pulmonary complications, malnutrition, disabling dysphagia, infections, esophagitis, esophageal diverticula, and, rarely, esophageal squamous cell carcinoma.[5,6]

The management of patients with end-stage achalasia is challenging, and the therapeutic options are limited, and esophagectomy will be eventually required in about 5 % of all patients with a diagnosis of achalasia.[7–9] Esophagectomy is a major surgical procedure with mortality rates reported around 5 % in most specialized, high-volume centers, and considerable overall morbidity rates, ranging between 26 and 66 %, regardless the chosen surgical approach.[10–12] Moreover, it has been suggested that esophageal resection is technically more difficult in patients with achalasia due to

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anatomical changes in the mediastinum induced by esophageal enlargement, presence of scarring, and tenacious adhesions caused by previous treatments and higher risk of bleeding due to the richer vasculature supplying the hypertrophic esophageal musculature.[12,13]

We performed a retrospective analysis using the Nationwide Inpatient Sample (NIS) over an 11-year period (2000–2010) and compared the surgical outcomes of patients admitted with a primary diagnosis of achalasia who underwent esophagectomy to patients who underwent esophagectomy for esophageal cancer during the same time period. This study attempts to assess if the pathological features of achalasia affect the outcome of esophagectomy.

Materials and Methods

Data Source and Study Population

This was a retrospective analysis comparing outcomes of patients after esophagectomy using NIS file over an 11-year period (2000–2010). NIS includes 20 % of representative sample of all US hospitals, and after applying weighting strategy, it produces national estimates.[14] International Classification of Diseases, ninth revision (ICD-9) was used to define the study population. Among patients undergoing esophagectomy (ICD-9 procedure codes 42.4, 42.41, 42.42, 42.5, 42.51-59, 42.6, and 42.61–69), we identified those with a primary diagnosis of esophageal achalasia (ICD-9 diagnoses code 530.0) and those with a primary diagnosis of esophageal cancer (ICD-9 diagnosis codes 150, 150.1–5, 150.8, and 151). Patients were stratified into these two groups for comparison. Patients with primary diagnosis of achalasia (without additional diagnosis of esophageal cancer) who underwent esophagectomy (group 1) were compared to those with esophageal cancer who underwent esophagectomy (group 2) during the same time period. Patients 17 years of age or younger were excluded.

Variables of interest included age, gender, race (defined as white, black, and other), and various comorbidities (history of myocardial infarction, congestive heart failure, chronic obstructive pulmonary disease (COPD), malnutrition, cerebrovascular, and renal diseases). Additionally, we identified all patients whose procedure included a colon interposition. We compared baseline comorbidities between the two groups using the variables that are utilized to calculate the Charlson comorbidity index.[15] We did not use the actual Charlson score in our analysis since it would not provide a reliable health assessment because the algorithm for computing Charlson score automatically assigns a value of 2 in cancer patients. This study was deemed exempt by the Johns Hopkins institutional review board.

Outcomes of Interest

The primary outcome was in-hospital mortality. Secondary outcomes included hospital length of stay (LOS), postoperative complications (pneumonia, urinary tract infection, shock/sepsis, pulmonary compromise, hemorrhage, acute myocardial infarction, unexpected reoperation, and renal failure), and total hospital charges. The complications were identified using previously validated ICD-9 diagnosis codes.[16–18] Hospital charges were adjusted for inflation to reflect 2011 US dollars.

Statistical Analysis

The statistics used on this study were survey statistics due to weighting strategy used by NIS. Categorical variables were expressed as frequencies and percentages and were compared with the Pearson χ^2 test. Continuous variables were presented as means or medians and were compared using the adjusted Wald test and Kruskal–Wallis test, respectively. A p value <0.05 was considered statistically significant. To comply with the data use agreement, any table cell with fewer than 11 observations was reported as less than 11. All analyses were conducted using Stata statistical software version 11.2/MP (StataCorp, College Station, Texas).

Comparison of variables of interest between esophageal achalasia and esophageal cancer patients undergoing esophagectomy revealed significant differences at baseline. Hence, propensity score matching analysis was performed to generate a population of well-matched patients. The purpose of the propensity score method is to identify treated and control individuals within the cohort with similar covariates. For this study, one-to-one nearest neighbor matching algorithm without replacement was applied, with regard to variables that were clinically important and statistically different between the two groups at baseline; in this case, age, gender, race, and history of COPD. This matching technique is one of the most widely used in literature. It takes each treated individual and searches for one control individual with the closest propensity score. Patients in both groups not able to be matched are discarded. Matching one nearest neighbor minimizes the bias and matching without replacement keeps variance low.[19]

A subgroup analysis was performed for all the patients who experienced in-hospital mortality. Initially, preoperative risk factors for the primary outcome of overall in-hospital mortality were examined using exploratory univariate analysis. Multivariable model was formed using the following variables with p value <0.20 in univariate analysis: age (categorized as 18–45, 46–55, 56–65, and >65 years old), congestive heart failure, COPD, malnutrition, and cerebrovascular and renal diseases. Additionally, univariate logistic regression was applied to evaluate postoperative complication impact on overall in-hospital mortality.

Results

Study Population

A total of 18,966 patients who underwent esophagectomy between 2000 and 2010 were identified. Of those, 963 (5.1 %) were patients with a diagnosis of esophageal achalasia, and the remaining 18,003 (94.9 %) were patients with a diagnosis of esophageal cancer (Table 1). Patients undergoing esophagectomy for achalasia were younger (median of 54 vs. 64 years, $p<0.001$) with an equal proportion of males and females. On the other hand, patients undergoing esophagectomy for esophageal cancer had higher proportion of males (80.32 vs. 49.01 %, $p<0.001$), Caucasians (84.53 vs. 68.28 %, $p<0.001$), history of myocardial infarction (3.36 vs. <1.14 %, $p=0.037$), and significantly higher COPD rates (19.82 vs. 8.01 %, $p<0.001$).

The rate of intrathoracic esophagogastrostomy was not statistically different between the achalasia and cancer patients (28 vs. 31 %, $p=0.305$); however, the proportion of patients undergoing colon interposition was higher in the achalasia group (3.63 vs. 1.03 %, $p<0.001$).

The overall in-hospital mortality was 7.45 % with significantly lower rate among achalasia patients (2.69 vs. 7.49 %, $p=0.016$). Although postoperative outcomes were comparable between the two groups, the median total hospital charges were significantly higher for achalasia patients ($115,087 vs. $99,654.2, $p=0.006$).

Table 1 Baseline demographic, clinical characteristics, and postoperative outcomes of patients undergoing esophagectomy, NIS, 2000–2010

	Total $N=18{,}966$	Group 1 esophagectomy for achalasia $n_1=963$ 5.08 %	Group 2 esophagectomy for cancer $n_2=18{,}003$ 94.92 %	*p*
Age, mean (median)	62.8 (63)	54.6 (54)	63.2 (64)	<0.001
Gender				<0.001
Male	14,932 (78.73 %)	472 (49.01 %)	14,460 (80.32 %)	
Female	4,034 (21.27 %)	491 (50.99 %)	3,543 (19.68 %)	
Race[a]				<0.001
White	12,102 (83.73 %)	493 (68.28 %)	11,609 (84.54 %)	
Black	992 (6.86 %)	86 (11.91 %)	906 (6.60 %)	
Other	1,360 (9.41 %)	143 (19.81 %)	1,217 (8.86 %)	
Comorbidities				
History of myocardial infarction	610 (3.22 %)	<11[b] (<1.14 %)	605 (3.36 %)	0.037
Congestive heart failure	989 (5.22 %)	26 (2.71 %)	963 (5.35 %)	0.112
COPD	3,645 (19.22 %)	77 (8.01 %)	3,568 (19.82 %)	<0.001
Cerebrovascular disease	382 (2.02 %)	26 (2.69 %)	382 (1.98 %)	0.502
Malnutrition	1,704 (8.98 %)	97 (10.10 %)	1,607 (8.93 %)	0.593
Renal disease	50 (3.45 %)	<11 (<1.52 %)	46 (0.25 %)	0.563
Diabetes	2,623 (13.83 %)	79 (8.20 %)	2,544 (14.13 %)	0.038
Outcomes				
In-hospital mortality	1,374 (7.45 %)	26 (2.69 %)	1,348 (7.49 %)	0.016
Pneumonia	3,462 (18.25 %)	164 (17.03 %)	3,298 (18.32 %)	0.651
Urinary tract infection	1,122 (5.92 %)	60 (6.23 %)	1,062 (5.90 %)	0.884
Shock/sepsis	1,123 (5.92 %)	46 (4.78 %)	1,077 (5.98 %)	0.485
Pulmonary compromise	5,240 (27.63 %)	280 (29.08 %)	4,960 (27.55 %)	0.689
Hemorrhage	712 (3.75 %)	30 (3.12 %)	682 (3.79 %)	0.675
Acute myocardial infarction	277 (1.46 %)	11 (1.14 %)	266 (1.48 %)	0.575
Unexpected reoperation	276 (1.46 %)	31 (3.22 %)	245 (1.36 %)	0.063
Renal failure	1,174 (6.19 %)	37 (3.84 %)	1,137(6.32 %)	0.148
Length of stay (days), median	12	13	12	0.774
Total hospital charges, median	$100,411.8	$115,087	$99,654.2	0.006

COPD chronic obstructive pulmonary disease

[a] Not every state reports race. Data on race were missing for 4,512 patients

[b] HCUP DUA prohibits the reporting of fewer than 11 observations

Matched Population

A total of 1,448 patients were identified after performing propensity score matching, with 724 patients in each group (Table 2). All variables of interest were comparable between the two groups. The postoperative outcomes, total hospital charges, and hospital LOS were similar between the two groups as well. However, the analysis showed a trend toward significant higher mortality for esophageal cancer patients (7.76 vs. 2.85 %, $p=0.077$).

Subgroup Analysis of Patients Who Experienced in-Hospital Mortality

Compared to patients with esophageal cancer, patients who died in the achalasia group were significantly older (median 74 vs. 67 years, $p=0.002$), and all of them were males. The esophageal cancer group had statistically significantly higher rates of congestive heart failure (0 vs. 13.51 %, $p=0.039$), COPD (0 vs. 31.11 %, $p<0.001$), and malnutrition (0 vs. 17.97 %, $p=0.009$), but was similar to achalasia group in terms of remaining comorbidities. Shock/sepsis was the only outcome that was significantly higher in the cancer group.

Among patients who died in both groups, the most common associated diagnoses were respiratory complications, shock/sepsis, and renal failure.

Multivariable analysis revealed that the likelihood of inpatient mortality increased with age, as expected (Table 3). Patients age 56–65 were over twice more likely to die ($p=0.031$), and patients 65 and older were over three times more likely to die ($p=0.007$) when compared to the reference group (18–45 years old). Patients with congestive heart failure, cerebrovascular, and renal diseases had nearly twice the odds of mortality, whereas patients with renal disease were over eight times more likely to die ($p=0.002$). Univariate analysis revealed that development of all examined postoperative

Table 2 Baseline demographic, clinical characteristics, and postoperative outcomes of matched patients undergoing esophagectomy, NIS, 2000-2010

	Total $N=1{,}448$	Group 1 esophagectomy for achalasia $n_2=724$	Group 2 esophagectomy for cancer $n_2=724$	*p*
Age, mean (median)		54.5 (54)	56 (56)	0.468
Gender				0.333
Male	652 (45.00 %)	351 (48.45 %)	301 (41.56 %)	
Female	796 (55.00 %)	373 (51.55 %)	373 (58.44 %)	
Race				0.895
White	986 (69.08 %)	494 (68.23 %)	492 (67.93 %)	
Black	185 (12.78 %)	86 (11.89 %)	99 (13.66 %)	
Other	277 (19.15 %)	144 (19.88 %)	133 (18.41 %)	
Comorbidities				
History of myocardial infarction	15 (1.04 %)	<11 (<1.52 %)	<11 (<1.52 %)	0.652
Congestive heart failure	35 (4.83 %)	26 (3.59 %)	9 (1.24 %)	0.196
COPD	102 (7.07 %)	49 (6.77 %)	53 (7.32 %)	0.858
Cerebrovascular disease	40 (2.76 %)	21 (2.90 %)	19 (2.62 %)	0.915
Malnutrition	0 (0 %)	0 (0 %)	0 (0 %)	1.000
Renal disease	50 (3.45 %)	<11 (<1.52 %)	46 (0.25 %)	0.563
Diabetes	122 (8.43 %)	55 (7.60 %)	67 (9.25 %)	0.655
Outcomes				
In-hospital mortality	77 (5.31 %)	21 (2.85 %)	56 (7.76 %)	0.077
Pneumonia	214 (14.80 %)	131 (18.11 %)	83 (11.48 %)	0.106
Urinary tract infection	89 (6.17 %)	60 (8.26 %)	29 (4.07 %)	0.153
Shock/sepsis	80 (5.53 %)	41 (5.73 %)	29 (5.33 %)	0.889
Pulmonary compromise	383 (26.42 %)	224 (30.88 %)	159 (21.97 %)	0.115
Hemorrhage	55 (3.80 %)	25 (3.45 %)	30 (4.14 %)	0.787
Acute myocardial infarction	33 (2.28 %)	15 (2.08 %)	18 (2.49 %)	0.795
Unexpected reoperation	35 (2.42 %)	21 (2.90 %)	14 (1.93 %)	0.624
Renal failure	52 (3.59 %)	23 (3.18 %)	29 (4.00 %)	0.723
Length of stay (days), median	12	12	12	0.877
Total hospital charges, median	$113,378	$117,860.4	$110,421.4	0.411

COPD chronic obstructive pulmonary disease

Table 3 Univariate and multivariate logistic regression for overall inpatient mortality

Preoperative risk factors	Univariate analysis		Multivariate analysis	
	OR (95 % CI)	*p*	OR (95 % CI)	*p*
Age 18–45	Reference	Reference	Reference	Reference
46–55	2.13 (0.87–5.21)	0.099	1.95 (0.80–4.78)	0.142
56–65	3.13 (1.27–7.73)	0.013	2.69 (1.10–6.62)	0.031
>65	4.27 (1.73–10.54)	0.002	3.44 (1.40–8.47)	0.007
Male	1.07 (.80–1.43)	0.651	–	–
Comorbidities				
Congestive heart failure	3.21 (2.17–4.73)	<0.001	2.57 (1.70–3.88)	<0.001
COPD	1.96 (1.50–2.54)	<0.001	1.64 (1.25–2.15)	<0.001
Cerebrovascular disease	2.66 (1.48–4.75)	0.001	2.26 (1.20–4.24)	0.011
Malnutrition	2.36 (1.70–3.27)	<0.001	2.17 (1.54–3.06)	<0.001
Renal disease	9.03 (2.55–32.03)	0.001	8.81 (2.18-35.58)	0.002
History of myocardial infarction	0.74 (0.34–1.61)	0.448	–	–

Multivariate model includes all covariates with *p* values <0.20 from univariate analysis

complications except for urinary tract infection was significantly associated with in-odds of hospital mortality (Table 4).

Discussion

While the results of Heller myotomy in the treatment of achalasia have been extensively reported, only small, single institution series, have described the outcomes following esophagectomy for this condition. In this retrospective analysis using a national database, we compared perioperative outcomes after esophagectomy in 963 achalasia patients to a cohort of 18,000 esophageal cancer controls. We found that operative outcomes, including mortality, overall morbidity, and LOS were comparable between these two groups using propensity matched analysis.

The use of esophagectomy for achalasia has been a subject of controversy among surgeons for quite some time. In large measure, this is due to the fact that achalasia is a nonmalignant condition, with a typically slow rate of progression. As such, esophagectomy—an operative procedure of far greater magnitude than myotomy—is considered by many to be a radical measure, best reserved for the treatment of malignant disease. While even a sigmoid esophagus can respond well to myotomy,[20] achalasia is nevertheless an incurable and progressive disease, for which esophagectomy may eventually become necessary. This happens when progression of disease and failure of endoscopic or surgical interventions lead to massive dilation of a functionless esophagus, disabling dysphagia, incomplete esophageal emptying, and peptic stricture from uncontrolled reflux disease.[7,21] Moreover, it is known that stasis of luminal contents induces diffuse squamous hyperplasia with papillomatosis and basal cell hyperplasia, predisposing to the development of esophageal squamous cell cancer in up to 3 to 10 % of patients.[22,23]

Critics of the use of esophagectomy in patients with achalasia posit that a variety of factors may actually make esophagectomy more technically challenging in such patients, thereby increasing its already significant morbidity and mortality risks. Such factors include (1) the displacement of mediastinal organs by the enlarging esophagus, with consequent adhesions formation, which may increase the difficulty of the operative dissection and mobilization; (2) the hypertrophy of the esophageal musculature in patients with achalasia is often accompanied by a concomitant hyperplasia of the esophageal blood supply, thereby increasing the hemorrhagic risks of esophagectomy in these;[20] (3) many achalasia patients have already undergone numerous esophageal interventions before coming to definitive surgery, and these prior treatments result in scarring and inflammation which can greatly complicate esophagectomy. The foregoing considerations notwithstanding, these concerns were not borne out by our findings; patients with achalasia who underwent esophagectomy in this study had no significant difference in LOS or postoperative

Table 4 Univariate logistic regression for overall inpatient mortality

Postoperative complications	OR (95 % CI)	*p*
Pneumonia	3.70 (2.84–4.81)	<0.001
Urinary tract infection	1.46 (0.94–2.26)	0.090
Shock/sepsis	8.18 (5.90–11.34)	<0.001
Pulmonary compromise	10.60 (7.94–14.16)	<0.001
Hemorrhage	2.39 (1.49–3.82)	<0.001
Acute myocardial infarction	5.80 (3.26–10.34)	<0.001
Unexpected reoperation	3.29 (1.55–6.96)	0.002
Renal failure	14.62 (10.69–19.99)	<0.001

outcomes (including bleeding and unexpected reoperation) compared with esophageal cancer patients in the propensity matched analyses.

Mortality and LOS observed in our achalasia group are comparable to those reported in the series described by Devaney et al., one of the largest in the literature.[20] However, the incidence of specific postoperative complications reported in the literature is heterogeneous and difficult to compare; demographic characteristics and severity of the disease, as well as indication for esophagectomy and technical surgical details, are different in the various retrospective series.[6,20] Moreover, complications are classified differently according to each author; this discrepancy could explain the variability in the incidence of postoperative complications which definition is subject to interpretation, like pneumonia, respiratory failure, arrhythmia, etc. Other specific complications like anastomotic leak, vocal cord paralysis, and chylothorax, which have a pretty comparable incidence rate in previous series, are not coded in the NIS and could not be evaluated in our study.[6,20,24,25]

Pneumonia and pulmonary compromise were the most common postoperative complications in both patient groups. This is similar to other studies, which have demonstrated comparable high rates of pulmonary complications (ranging from 14.5 to 21 %) after esophagectomy for either benign or malignant disease.[6,26,27] This is not surprising, given the high prevalence of preexisting pulmonary functional abnormalities in patients with chronic esophageal disease.[28,29] Interestingly, we found no difference in the rate of pulmonary complications between the cancer and achalasia group.

The rate of reoperation was higher in the achalasia group when compared to the cancer group; however, the data did not reach significance neither at baseline nor after matching. Unfortunately, there is no way to determine the reason for reoperation using NIS database; however, there was a higher percentage of malnourished patients in the achalasia patients who underwent reoperation, and this can partially explain the difference between the groups. In our unmatched analysis, we noted a significantly higher in-hospital mortality rate among patients who underwent esophagectomy for esophageal cancer. Employing univariate and multivariate logistic regression to better analyze preoperative factors correlated with overall inpatient mortality, we found that the risk factors most strongly associated with mortality were age >65, preoperative renal disease, and preoperative congestive heart failure. The postoperative complications most likely to lead to mortality were pneumonia, shock/sepsis, pulmonary compromise, renal failure, and acute myocardial infarction. However, preoperative esophageal pathology (achalasia or esophageal cancer) was not, in itself, an independent predictor of mortality risk and could not explain the aforementioned discrepancy in mortality between the two groups.

The median total hospital charges were significantly higher for achalasia patients ($115,087 vs. $99,654.2, $p = 0.006$), even if postoperative outcomes were comparable between the two groups. This is maybe explained by a twofold higher reoperation rate and a 1-day longer median LOS in the achalasia group.

It is worth noting that, in our study, we found that colon interposition was performed more frequently in the achalasia group than in patients with malignant disease. Although there is controversy about this in the literature, Watson et al.[30] have advocated that esophagogastrostomy is suboptimal in benign conditions requiring esophageal replacement. It seems reasonable to assume that the perspective of better long-term results provided by colon interposition as compared with gastric interposition (i.e., the lower incidence of anastomotic stricture, regurgitation, dumping syndrome, and long-term reflux complications in the esophageal remnant) made this a more attractive reconstruction option in the achalasia group, whose patients were generally younger, healthier, and had greater life expectancy than the patients with malignant disease.[21,22,31,32] Despite the greater complexity of colon interposition, a higher number of surgeons in this study elected to utilize this reconstruction method when performing esophagectomy for achalasia compared to the cancer group.

There are several limitations to our study. First are those associated with the use of an administrative dataset such as the Nationwide Inpatient Sample. It has been well documented that claims-based databases, which are constructed primarily for reimbursement rather than research purposes, are inherently susceptible to errors due to missing or inaccurately entered codes.[33] Our data are not sufficiently robust to explain the difference in mortality noted between these two cohorts. Since the baseline comorbidities and common postoperative complications appear to be similar between the two groups, it is possible that some, as yet unmeasured, factor(s) not captured by this dataset played a significant but still to be clarified role. Moreover, several perioperative variables that could theoretically add relevance to our analysis are not available with the NIS database; there is no data on the percentage of patients who received neoadjuvant and adjuvant treatments, nor information on postoperative quality of life and events occurring after patients' discharge. Even though the ultimate goal of surgery for esophageal functional disease should be considered symptomatic relief rather than survival, large administrative datasets do not provide enough information about these outcome measures. Reporting on overall morbidity and mortality after esophagectomy for achalasia may encourage surgeons to consider this operation a valid therapeutic option for patient who have exhausted other less invasive strategies.

Pellegrini et al. recommended to use a stepwise approach for patients who have failed myotomy, with dilation followed by redo Heller, and to reserve esophagectomy only for patients who did not improve after a second myotomy.[34] In their study, however, four out of six patients with stage IV disease had treatment failure with this approach. At the same time, Devaney and colleagues outlined how, in their experience, multiple prior esophageal operations were significantly associated with a poorer functional outcome after esophagectomy.[20] Our data suggest that the natural history of achalasia does not worsen the outcomes of esophagectomy; therefore, esophagectomy should be considered a safe option for the treatment of achalasia patients with advanced disease who are likely not to respond successfully to other measures.

Conclusion

This represents the largest study to date examining perioperative outcomes after esophagectomy in patients with achalasia. Despite the inherent limitations of administrative datasets already discussed, the large number of patients provided by this database yields a valuable statistical tool to allow us to formulate meaningful management recommendations. These data are encouraging, and suggest that esophagectomy for end-stage achalasia should be considered a safe option. Based on these findings, we believe that surgeons should not be unduly reticent to consider esophagectomy for end-stage achalasia, based simply on a perceived notion of prohibitive operative risk in this patient population.

Conflicts of Interest None

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